SCIENCE

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PROBLEMS OF BIOLOGY.

A BOOK entitled 'Problems of Biology' has recently been issued from the press of Swan, Sonnenschein & Co., which is in many repects remarkable. Its author, Mr. George Sandeman, is evidently a metaphysician whose knowledge of biology is limited largely to theoretical writings. His style is peculiarly obscure and incoherent; *e. g.*, the following is the preface: "This volume contains the criticism of the contemporary biological systems. That enquiry is necessary as an introduction to the study of the problems of organic life, but it is not in itself a doctrine of biology. The argument ought to proceed to the discussion of the philosophy of nature." There is a flavor of dogmatism, pedantry and extravagance about the book, and often one does not know whether the author is in earnest or is perpetrating a huge satirical joke. But, in spite of all these imperfections and uncertainties, there are many keen and just criticisms of certain popular biological doctrines and methods.

The contents are divided into five chapters, the first of which is a far-going criticism of the Methods of Biology. There is, we are told, a remarkable anarchy within the science as well as a certain indefiniteness in its scope. "The inner confusion of biology depends upon the form of the science. The *necessary* form is a theory of individuality. The *professed* form is the

induction of general laws from known facts. The *actual* form is a certain product of these two factors. Each biological system has to answer two questions: How are the qualities of the individual related to one another? And, How do the qualities exist by reason of their significance?" The various systems are complete and final in themselves and are mutually exclusive. "There is complete independence of one another and almost complete independence of research. If it were not so they would combine and research would discriminate between them. There are twenty good theories of the development of the individual, but I cannot say that any one seems to be better or worse than all of the rest. A certain controversy with regard to natural selection and use inheritance lived long and was discussed in every public place and with the aid of hosts of detailed observations. Yet it was never cleared up and neither side had the advantage; but because men become weary of it, it has now been allowed to rest. It is not otherwise with the history of biology. New systems supersede old ones and the latter are not disproved but forgotten. * * * These are some of the features of the inner confusion. They have made the very name of biology a by-word. And though the anarchy may not be obvious to a people delighting in formulæ which may be applied with equal facility and barrenness to everything which is organic, it is so present to men of research that they leave the whole matter on one side as simply not pertinent to their occupation, and are not patient to bear even the mention of what they repudiate with more justice than they are always aware, as metaphysics."

Such a criticism is plausible and misleading. In biology, as in other sciences, there is a field of well ascertained facts and of well grounded theories, and outside of this there is a region of hypothesis which, as in chemistry and physics, extends out beyond observation and experiment and thus enters the sphere of metaphysics. Because popular interest is so largely drawn to the borderland problems, our author seems to assume that the whole science is merely an aggregation of crude, pioneer hypotheses. It will astonish many persons to learn that the theories of biology are completely independent of each other and of research, that they cannot combine and that research cannot discriminate between them. There was once held a doctrine of preformation which taught that the homunculus existed *as such* in the egg or sperm. Does any one hold that view to-day? There was once an opposing doctrine of epigenesis which taught that the egg or sperm is *unorganized* matter. Does any one still hold this view, and has research had nothing to do in settling this famous controversy? This single instance, and many others could be cited, proves that what appear to be contradictory views may be harmonized when research has made our knowledge of the subject more complete; and in this biology does not differ from any other science. Other problems, though not absolutely settled by research, are out-grown and forgotten; we do not care to seriously discuss the *circuitus gallinaceus* to-day; the narrow limits of the old problem have been outgrown, and it is not otherwise with any science: "The old order changeth, yielding place to new." The ideas of many people are hazy as to the significance of the word *biology*; by some it has been regarded with suspicion; by others it has been used to conjure with, but who will not be surprised to learn that the name *biology* is a by-word? To be sure, it does have the same sound, but the spelling ought to save it.

Another subject of the author's criticism is the vagueness, ambiguity and self-contradiction of the most important terms and conceptions of biology; *e. g.*, *function*, *acquired character*, *inherited character*, etc.

This criticism is especially applicable to the most general and inclusive terms of biology and of many other sciences. It is unfortunately true that many biological definitions are not as clear cut and consistent as they should be, but where a definition includes a great mass of little known phenomena nothing better can be expected; it would be ungracious on the part of the biologists not to be thankful to the philosophical critics for pointing out these inconsistencies, but the real remedy here, as in the matter of unsatisfactory hypotheses, lies not in criticism, but in exploring more thoroughly the facts and phenomena in question.

But leaving the general introduction and passing to the more specific criticism of the methods of biology, we are told that the actual form of theoretical biology is dependent upon three postulates: 1. "The qualities of the individual are discrete, numerable constituent elements of which the organism is the total sum, and have, therefore, each the value of an ultimate unit for biology. They are thus independent of one another as regards their significance, maintenance, development in the individual, existence when latent, inheritance and variation and acquirement by the race." 2. "The qualities of the organism and all its stages are the manifestation of, and are related to one another only through, an agent or system of agents within the known body. The agent which answers to the unity of the organism is purely self-determining; it is in the attitude of pure activity to the body, which in consequence is in the attitude of pure passivity to the agent. * * * It carries the qualities when they are latent and carries alternative qualities, and it manifests these when and where they ought to be manifested." 3. "The adaptedness of organisms is due to the external addition of new qualities to the rest, which henceforward are included among, but not conditioned by, the qualities which have up to that time existed. The environment is something separate from the organism; and the latter is, by the addition of new qualities to the trust of the agent, thus educated up to circumstances which can exist without it. The inertia of the agent is such that it may persist in presenting qualities which are unrelated to other qualities and which have ceased to have any special external and independent use. The various qualities of the organism are thus due to the slow addition of modifications through many years of changing circumstances."

At first thought it will be doubted whether any biological system makes any such radical demands as are contained in these three postulates; certainly few biologists are conscious of making such demands, and yet the author shows, with much ability and a wealth of illustration, that this is the logical outcome of many biological doctrines.

The book is almost entirely devoted to a philosophical criticism of these three postulates. This criticism is, in the main, clear sighted and well founded. After declaring that these postulates are not working hypotheses and in themselves are of no value to research, the author points out their weaknesses from the standpoint of philosophy. "The first and second postulates arise from the relativist theory of knowledge and the agent is the thing-in-itself * * * The whole method depends upon a fiction; * * * it is a mere logical fallacy. If biology is to treat of *individuality* we need a better form of doctrine than that of the agent." As to the third postulate, it presupposes the transformation of species, in favor of which doctrine the author sees but little direct evidence, though he feels compelled to accept it because of analogy with other systems.

I. In the second, third and fourth chapters the author deals at length with the

three postulates named. As to the first, he says that it is actually affirmed, or at least assumed, in many theories of general biology, of which the following are illustrations:

1. Nägeli, De Vries and many other biologists think it necessary to believe in separate, discrete and numerable hereditary units which exist in a kind of symbiosis in the organism. The qualities which are represented by these units may be morphological, physiological, latent, alternative, stages in development, etc.; in fact, every difference in the organism is to be distinguished as a separate constituent element.

2. This postulate is also closely associated with the cell theory, which has become unduly important under its influence. "It is possible to so insist on the multitude, on the similarity and on the independence of cells as to deny the supreme individuality of the body. The whole organism, it is said, is but a colony of these, the true individuals, and the secret of its form is to be found in their habits of growth, reproduction and differentiation. And so the question of the whole and the parts is removed from the sphere of the body, in which we have some opportunity of studying it, only to be repeated in the microscopic sphere of the individual cells. * * * If the individuality of the body is to be slurred over we have a right to expect that some architectural principle should be found in the cell itself. * * But I find no such attempt to fill up the conception of cells as anthropomorphic agents. * * We are not likely to find within an individual abstracted from a system in which it is only an element, the principle of the architecture of the whole system. * * Myriads of miserable Egyptians carried stones to the Pyramids; but no microscopic watching of any of these, stone and all, would ever explain the Pyramid itself."

3. Another illustration of this first postulate is found in the doctrine of the independence of parts, particularly put forward by Roux in his 'Struggle of the Parts.' "There must be some curious fascination about this conception of *struggle* that it should be introduced into the explanation of the parts of that which is the most perfect and unique unity we know."

4. The ordinary conception of independent variability of parts implies independence of qualities. If variations are really independent then we may at once give up the unity of the organism. The author argues that there is no such thing as independent variability, that all variations are correlated. Darwin's cases of correlated variations, viz., hairless dogs having imperfect teeth, white cats being deaf, etc., are only whimsical instances of a general law of correlation of parts. Natural selection, by insisting on independent variability, is unable to explain the numerous coordinated variations necessary to make the variation of a single part effective. The same difficulty is met, though to a less extent, by the advocates of use inheritance, for here also qualities are considered as primarily independent. "Confusion inevitably awaits any theory which moves by the disintegration of the individual into self-sufficient and primarily unrelated parts."

5. "This first postulate is further shown in the ordinary biological treatment of *functionless* parts, which are supposed to exist in their own right and in virtue of a separate inheritance. A functionless part of an organism is not useless; it is merely useless in a certain manner. * * * Nothing organic is functionless, except for a certain special abstract point of view." Every part is in some way related to every other part, and the very fact that a structure exists at all is evidence that in the process of its origin, development and maintenance it is functionally related to other parts. "One is apt to hastily assume that the significance of the part to the individual has nothing to

do with its rise and maintenance in the individual, and this assumption, when it is generalized, becomes the law that structure precedes function in the individual development. The whole movement of thought is due to the attribution of a merely abstract and external significance to the part."

6. "The postulate of the independence of parts is further found in the biological treatment of *latent* and of *alternative* parts and qualities. * * * The manifold features of the organism are latent in the germ; * * * regeneration of lost parts is due to the existence of the necessary parts in a latent condition; * * * all organic differences are inherited in latency and may vary when latent; * * * each generation in alteration of generations contains the other in latent condition; each sex holds as latent the alternative characters to its own; every change which the species undergoes in new conditions was latent in it before. * * * Latency is the chief category of biology. * * * Now, whatever is latent is simply not there; it has no existence. * * * Latency is possibility, and a thing is possible because of something else. And the problem of biology is to find a form for that *something else*. * * * The biological treatment of latent qualities shows that they are looked upon as independent of the rest." Against this position the author urges the great number of possibilities open to an organism under varying stimuli. "There is much more latent in an organism than is ever actual at any one time, and if all the possibilities are separate things we must invent a form for them in which they can be present in infinite numbers within a microscopic cell." In his treatment of alternative qualities the author admits that latency is not the same as possibility, for here we have one of two perfect forms developed, which may be wonderfully adapted to each other, as, for example, in the two sexes. He concludes, as have all who have reflected upon this subject, that it is necessary to assume some mechanism which will react in one of two definite ways. In treating of this subject his use of the word *Anlage* is unusual. "The *Anlage*," says he, "is not a thing which has ever been seen, but is that hypothetical object which represents the latent existence of one future particular." A glance at any text-book of embryology would show that a nascent, *visible* structure which has not yet the form and function of the developed part is frequently called the *Anlage* of that part.

7. Finally, this postulate dominates the doctrines of organic evolution; since each part exists in its own right, it is easy to imagine the putting together of this or that adaptation, the subtraction or addition of this or that part to any extent and in any combination that is able to survive.

In conclusion, the author affirms: "Organic differences of every kind are not separate elements; they are not numerable units, and the organism is not a mere sum of such units. To find that this is the case one has only to attempt to find one character in an organism which is not at once a part of a larger whole and itself capable of analysis into a hundred subordinate relations. * * * However much we may appear to gain for biology by separating the organism into things which play upon one another externally, * * * we really do no more than to do away with the individuality of a natural system in order to invest its parts with the more unique character of moral agents."

II. The second postulate, viz., that there is a self-determining agent within the known body, in which the unity of the organism inheres, is a necessary consequence of the first postulate, for as the latter breaks the organism up into separate and independent qualities so the former finds the unifying principle in the anthropomorphic agent. This agent is concieved under two different

guises: (1) as a material bearer or vehicle of the qualities; (2) as a quasi-psychical principle. The majority of biologists are advocates of the former view, among them Darwin, Spencer, Haeckel, Nägeli, DeVries, Wiesner, Weismann; the latter view has had numerous adherents from Bruno to Bunge, among them Stahl, Jaeger, Bunge and Hartmann.

With remarkable insight, the author criticises the theories of DeVries, Spencer, Weismann and Nägeli. The gist of this criticism can be given here in only a few fragmentary extracts. As to DeVries' theory of Pangenesis he says, after giving DeVries' point of view by various quotations from his work: "It seems fairly evident that we have to do with a metaphysical question alone, in all these quotations, just the question of identity in difference, of substance and quality. The pangenes are anthropomorphic agents, each one of which is a material vehicle of a special quality. They are anthromorphic because they are purely self-determining and not passive, and because they know the right and do it. They become functional *when it is time for them to do so*; they slip out of the nucleus *when they are needed* outside; they go through the cytoplasm to that part of the cell *which requires* their quality."

An account of Spencer's theory of Physiological Units is then given and their contradictory qualities are pointed out. "The agents (units) are now similar to one another, and again dissimilar; they are now merely constitutive and again directing. The units are different when considered in relation to the differences of the body, but they are identical when considered in relation to the ideal identity of these differences. When a distinction is thus substituted for a vague self-contradiction the units themselves present that problem of the organism for the satisfaction of which they were invented. They have the two aspects of identity and difference, and can no longer be the identity for the given differences of the body, so that they become useless."

Weismann's theory of the Germplasm is then briefly sketched, and in conclusion the author says: "Let us compare the determinant to an organism. Like the organism, the determinant can retain its proper form and functions and is the same determinant through all changes. It is fed; it reproduces itself. It is not homogeneous, but contains many ordered differences, and in virtue of its qualities it does its work. Now all its qualities are surely not the mere result of one another, for if they were it would not retain its identity through all the differences of its life any more than the organism would do if cells were conditioned by cells and stages by stages. You, therefore, need another system of determinants to control the determinants of Weismann as soon as anything is known about these, and to be the vehicles of their qualities; and you must then examine that new system in order to see whether or no you need yet another."

Nägeli's theory of Idioplasm is next considered, and it is shown that Nägeli regards the idioplasm as mere difference at one time and as mere identity at another, and finally that he considers it a quasi-psychical principle which brings forth *suitable* qualities at the *appropriate* time. Nägeli himself draws an analogy between the idioplasm and a pianist, and in this analogy the author finds a satisfactory summary of Nägeli's theory and a sufficient condemnation of it. "The *sounds* answer to the manifold differences of appearance; the *keys* to the idioplasm as mere differences; the *pianist* to the idioplasm as abstract identity; and, lastly, the *score* to the ideal unity in multiplicity. Now the analogy differs from the known body in one respect, that it inserts between the phenomenal differences and the

ideal unity, two steps; I mean the abstract difference of the keys and the abstract identity of the pianist. And Nägeli's theory, like all other theories of ontogeny, exists only in order to insert those two steps."

The author then proceeds to a consideration of the agent as a quasi-psychical principle, and as illustrating all doctrines of the class he chooses the theory of Bunge as set forth in his essay on Vitalism and Mechanism, in which there is laid down the familiar distinction between physical and chemical processes, on the one hand, and vital processes, on the other. "The former as *mechanical* are set over against the latter as *in some way not mechanical*, but as free from reciprocity and as conditioned only by ends. * * * But we have no reason for excepting psychical *processes* from that form under which we include the rest of the organism. Thinking is not miracle any more than 'cerebration' is miracle, and as a process it is as much in bondage to necessity as anything else is. * * * The *purposefulness* of the organic differences is that which has to be explained, but the two kinds of processes which are here distinguished do not differ in respect of that matter. Both are, if both exist, equally purposive in fact and equally mechanical in derivation. And all that the theory seems to do is to add to one set of processes another set which does not at all help us in the explanation of the former. * * * An intelligence is, indeed, an identity in difference, and it is perhaps natural that we should seek to insert such an intelligence into the organism as the agent of its identity. But an intelligence is the unity of its own differences—its own states; there is no conceivable sense in which it should be unity for the parts of the body."

In conclusion, the author examines the various theories of the agent in their relation to fact and as to their characteristics as a method. As to their relation to fact he attempts to apply these theories to the structure and functions of the Protozoa. What is the inner secret of the remarkable outer differences which are found in this group? "The agent here is of no avail, for you cannot divide up these creatures into separate cooperating cells nor regard their qualities as carried by vehicles. You cannot, in short, in their case delude yourself with the belief that individuality in organisms is a vain show due to the external action of an agent or system of agents upon the passive material which is known to us in research. * * * I believe I am right in saying that *no explanation of the immediate existence of any morphological element has ever been made.* And this fact, veiled in the case of the Metazoa, because in their case an external significance for the structure can so easily be found or feigned, lies open to us chiefly in the case of the unicellular animals, in which we are at once forced to see that form must have its *rationale* and to confess that this *rationale* is hidden from us."

As to the general characteristics of the hypothetical agents the author observes: (1) that they are not known and have not been observed; (2) they are a scaffolding for the synthesis of abstract sciences; (3) they are alogical, and (4) they are unknowable. "In all these characteristics of the agent there is but one endeavor on the part of the theorists; it is to find an expression for the unity of the organism. But the method seems to me to be so riddled with contradictions as soon as it is taken seriously, and to be in any case so formal and inefficient, that we had better leave the whole problem alone than solve it by the empty doctrine of the independence of organic qualities and by the empty hypothesis of the anthropomorphic agent."

III. The third postulate is the basis for all theories of adaptation, whether they be those of evolution or of design. It proceeds from the assumption that "everything organic exists only by reason of, and is to

be explained only in relation to, some special use which it now has or which a similar structure has had in former times." As well might one say that grass was made for cows to feed on, or that day and night alternate that we may have light for work and darkness for sleep. If a special function cannot be assigned to a structure as its *raison d'etre* it is commonly regarded in one of three ways: (1) the function has not yet been discovered; (2) the structure is necessarily involved in the structure of other parts which have a special function; (3) the structure is 'vestigial' and its special function has been lost, though the part itself is continued by force of inheritance. There are serious objections to assigning a special function to every part for the fulfilling of which the structure exists: in the first place, the special use is only one of many, and frequently not the most important one, which the part performs; secondly, the special use is merely conjectural, and which of the many uses it has is most important cannot be determined. It is impossible for conscious, reflecting beings to give a complete account of the causes of all their actions; much more must this be true of the uses of parts of organisms viewed objectively.

Three 'factors of evolution' are then considered, viz: Lamarckism, Use-inheritance, Natural Selection. Lamarck derives the adaptations of organisms from their needs. A certain confusion exists in his theory due to ambiguity in the use of the word '*besoin*,' which in some connections means *need*, in others *desire*. After quoting several important passages from the *Philosophie Zoologique*, the author says: "Now, all this doubtless appears very ridiculous, and, though it is as good as any theory of transformation, so it is. But it reveals one thing, a haunting sense on the part of Lamarck that he must bring in the conception of need at every point. These are no facts which he is relating to us; they are a set of the most varied and confused fancies as to how *need* can bring about the adaptations of organic life. Of the fact that need effects all this he is well assured, but his knowledge goes no further. And he finds it extraordinarily difficult to imagine how the indispensable principle of his theory does its work. Sometimes that which is needed is represented as actually thought of by the animal, sometimes as merely present to its 'inner feeling,' and sometimes as belonging to the animal only in one respect —in that it would be well for the animal to have it, though it has it not. Sometimes the creature needs the particular structure because of other habits or structures which it has already, and which could not exist in fact without that which is represented here as derived from their need of it. In a word, the main principle of a biological system could not well be more formal and all-inclusive, or in its working-out more indefinite."

As to Use-inheritance the author at once denies the distinction between innate and acquired characters. He takes, as a basis of discussion, the definitions of these terms given by Delage in his work on Heredity, viz: "Innate characters are those which have been contained in the fertilized ovum in some form or other; whether that form is known or not matters little. Acquired characters, on the other hand, are those which have been developed only through the action of the surrounding conditions." But the innate characters cannot be present *as such* in the ovum; they must be there only as separate and unknowable agents, for if present only in the sense that they are *possible* we cannot distinguish them from acquired characters which are also possible. On the other hand, acquired characters must be represented in some form in the germ. If they are only modifications of innate qualities they are innate qualities which are usually latent. "And not only

are acquired characters innate in that they are possible to the germ (and that is the only innateness of which we know anything or can at all credit), but the innate qualities are also acquired. They are, to use Delage's own definition of acquired characters, developed through the action of surrounding conditions." Only through the action of surrounding conditions are characters of any sort developed.

"Everyone admits that the experiences of the parents will in some way or other affect the germ and, therefore, the offspring. Are these changes identical in kind with those changes of the parent which gave rise to them? * * * The only method of exploring the question would be through the whole physiological history of the germ and of its development. * * * It is absolutely necessary that we should know this intermediate germ form and how it relates to the soma whence it comes, as well as how it relates to the soma which springs from it, before we can say what degrees and kinds of effect the particulars of the parent have on the far other pattern of the particulars of the germ, and what degrees and kinds of effect the particulars of the germ have upon the particulars of the embryo."

The consideration of Natural Selection falls under two heads: (1) a discussion of the struggle for existence; (2) a criticism of Delage's objections to the doctrine. As to the struggle for existence the author maintains that in the Darwinian sense every relation of an organism, whether external or internal, may be regarded as a struggle. Species struggle with each other and with their environment, parts and organs struggle with each other, and unknowable agents with unknowable agents. "The mother struggles with her child for nourishment. All individuals of one sex struggle with one another for those of the opposite sex. Parents struggle for representation in their offspring, and even forgotten ancestors, we are told, are separately within us, conflicting among themselves for another sight of the sun. In none of these cases do we see any struggle; we see merely results, and the struggle is a method of explaining them. * * It comes to be a question why we should speak of two things as *interfering with* one another, rather than as being *related to* or as conditioning one another in such and such a way. * * * The struggle between species or between the members of a species being, as we understand, a conflict by means of all qualities which have external uses, it is no more a special phenomenon of natural history than the struggle between the members of my body is a fact of physiology. In either case we have to do with nothing more than with a merely general anthropomorphic expression for relation."

The author then discusses seven objections which Delage sets down against the adequacy of natural selection in species formation. He agrees neither with Darwin nor with Delage. The objections to the doctrine of natural selection are not as to details; they lie at the basis of the whole method. The question is not whether natural selection is an all-sufficient factor of evolution, as Darwinians maintain, nor yet whether it is a subordinate factor, as Delage maintains, but whether it is a factor at all.

The book concludes with a brief chapter on the 'Unity of the Organism.' It is argued in a very positive fashion that the unity of the organism cannot be found in the protoplasm; that it cannot be found in any agents supposed to reside within the protoplasm; that it cannot be found in unity of feeling or the immanent soul, and that it can be found only in the *character* as distinguished from the characteristics. "We can regard all particulars as manifestations and components of one character. That character may develop itself in the ontogeny, but it does not

change. It is the same in the simplicity of the germ as in the complexity of the image. It is identical under the differences of male and female. It is the common nature, though no common quality, of germ and somatic cell, and of the elements of the different tissues. Individuals which differ from one another differ by one difference which, however, cannot be described except as an infinite number of differences, and all the features of one individual are one character. This is not the character of the protoplasm, nor of the idioplasm, nor of the immanent soul, but of the whole creature. And this character is no cause or condition amongst others. It is an aspect of all and is that aspect by which all comes into unity."

As thus defined the character, and hence the unity, of the organism is a purely metaphysical conception, wholly removed from the possibilities of research, and for my part I cannot conceive how such a conception can in any way advance our knowledge of organisms or assist us in the study of vital processes.

The basis of the whole criticism is the first postulate, which, in one respect at least, is wide of the truth. This postulate asserts that the qualities of an organism are *absolutely* separate and distinct elements. This, no one I suppose, has ever explicitly assumed or believed. If it were granted that the qualities of the organism are not absolutely independent, that the elements of the germ are related to each other as are the parts of the adult, the foundations of much of the criticism would be removed. But even as it is, the book will serve a good purpose as pointing out certain dangerous tendencies in recent biological speculations, and it should be read by all those who are interested in such speculations or who are in danger of rushing into biological metaphysics. It is a pity that the book is divided into chapters only and that there are no subordinate headings or numerical indices to indicate the subdivisions of the argument, and also that in many places the style is obscure, dogmatic and metaphysical, since with all these evident defects it will hardly obtain the reading which it otherwise deserves.

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*LANGUAGE STUDY.**

From a general consideration of the child's training it becomes evident that the great subjects which are most useful for discipline in the period of secondary education are the mathematical studies on the one hand, which exercise the faculty of abstraction, and the positive sciences, which train the power of observation and require truth to detail. If we should pursue the subject into the collegiate period we should find mental and moral science, literature and history coming to their rights. If this be in the main psychological we see that language study, as such, should have no great place in secondary education. The study of grammar, as has been already said, is very useful in the early periods of development if taught vocally; it brings the child out in self-expression, and carries its own correctives, from the fact that its results are always open to social control. These are, in my mind, the main functions of the study of language.

What, then, is the justification for devoting ten or twelve years of the youth's time to study of a dead language, as is commonly done in the case of Latin? The utility of expression does not enter into it, and the discipline of truth to elegant literary copy can be even so well attained from the study of our own tongue, which is lamentably neglected. In all this dreary language study the youth's interest is dried up

* Extract from *The Story of the Mind* in the press of D. Appleton & Co. (Useful Story Series.)

at its source. He is fed on formulas and rules; he has no outlet for invention or discovery; lists of exceptions to the rules destroy the remnant of his curiosity and incentive; even reasoning from analogy is strictly forbidden him; he is shut up from nature as in a room with no windows; the dictionary is his authority as absolute and final as it is flat and sterile. His very industry, being forced rather than spontaneous, makes him mentally, no less than physically, stoop-shouldered and near-sighted. It seems to be one of those mistakes of the past still so well lodged in tradition and class rivalry that soundness of culture is artificially identified with its maintenance. Yet there is no reason that the spirit of classical culture and the durable elements of Greek and Roman life should not be as well acquired—nay, better—from the study of history, archæology and literature. For this language work is not study of literature. Not one in one hundred of the students who are forced through the periodical examinations in these languages ever gets any insight into their æsthetic quality or any inspiration from their form.

But more than this. At least one positively vicious effect follows from language study with grammar and lexicon, no matter what the language be. *The habit of intellectual guessing* grows with the need of continuous effort in putting together elements which go together for no particular reason. When a thing can not be reasoned out, it may just as well be guessed out. The guess is always easier than the dictionary, and, if successful, it answers just as well. Moreover, the teacher has no way of distinguishing the pupil's replies which are due to the guess from those due to honest work. I venture to say, from personal experience, that no one who has been through the usual classical course in college and before it has not more than once staked his all upon the happy guess at the stubborn author's meaning. This shallow device becomes a substitute for honest struggle. And it is more than shallow; to guess is dishonest. It is a servant to unworthy inertia; and worse, it is a cloak to mental unreadinesss and to conscious moral cowardice. The guess is a bluff to fortune when the honest gauntlet of ignorance should be thrown down to the issue.

The effects of this show themselves in a habit of mind tolerated in persons of a literary bent, which is in marked contrast to that demanded and exemplified by science. I think that much of our literary impressionism and sentimentalism reveal the guessing habit.

Yet why guess? Why be content with an impression? Why hint of a 'certain this and a certain that' when the 'certain,' if it means anything, commonly means the uncertain? Things worth writing about should be formulated clearly enough to be understood. Why let the personal reaction of the individual's feeling suffice? Our youth need to be told that the guess is immoral, that hypothesis is the servant of research, that the private impression instructs nobody, that presentiment is usually wrong, that science is the best antidote to the fear of ghosts, and that the reply 'I guess so' betrays itself, whether it arise from bravado, from cowardice, or from literary finesse! I think that the great need of our life is honesty, that the bulwark of honesty in education is exact knowledge with the scientific habit of mind, and, furthermore, that the greatest hindrance to these things is the training which does not, with all the sanctions at its command, distinguish the real, with its infallible tests, from the shadowy and vague, but which contents itself with the throw of the intellectual dice box. Any study which tends to make the difference between truth and error pass with the throwing of a die, and which leads the student to be content

with a result he can not verify, has somewhat the function in his education of the puzzle in our society amusements or the game of sliced animals in the nursery.

J. Mark Baldwin.

Princeton.

THE WORK AT THE BIOLOGICAL LABORATORY OF THE U. S. FISH COMMISSION AT WOODS HOLL.

Three months ago the United States Fish Commission announced that its Biological Laboratory would be reopened; that it would be equipped for investigation; that men of science would be welcome, and that every effort would be made to collect all needed material, and to furnish, within certain limits, all necessary instruments and apparatus for research. The Station is the most extensive plant for the study of marine life and practical fish-culture in the world. There are four buildings: The Hatchery, Laboratory and Aquarium; the Residence; the Shops and Store House; and the Power House. It is in possession of a small fleet of steam and sailing vessels, and by special enactment the officers are empowered to use, at their discretion, any means for the capture of fish or other marine organisms.

The Commission has refurnished the Biological Laboratory and added ten new rooms for research. It has equipped a laboratory for physiology. It has purchased a bacteriological outfit, and a creditable library of biology and fish-culture has been installed. Two steam launches and the schooner Grampus have been attached to the Station, several fine-mesh seines, trawls and tow-nets have been purchased, and a large fish-trap has been placed at a favorable locality.

From the day of the opening of the laboratory, April 1st, several tables have been continuously occupied, and, at the present time, the scientific force numbers twenty-four. Several have expressed the desire of extending their work during the autumn and winter months, and it is proposed to keep the laboratory open throughout the year.

The Commission does not attempt to instruct or to dictate as to what lines of research are to be pursued, how the work shall be carried on, or where the results shall be published. It is convinced that all lines of biological research are indirectly, if not also directly, helpful to its more immediately practical work, and it happens that fully one-half of the investigators are now busy with problems bearing directly upon the anatomy, embryology, physiology and pathology of fish. The large corps of collaborators has made it possible to secure definite data respecting the breeding habits of many marine forms. The floating-fauna has been systematically examined; valuable information has been gained respecting the larval life of the star-fish, the developmental stages of the clam, the rate of growth of the scallops, the causes of mortality of lobster fry, and the pathogenic bacteria infesting fish.

With the cooperation of the Marine Biological Laboratory, it is proposed to make a series of synchronous observations on the temperature and floating fauna of Vineyard Sound. The combined vessels of the two laboratories provide a sufficiently large fleet to make these observations of special interest. It is also proposed to resume again the deep-sea work begun by the Commission many years ago, though the temporary use of the Fish Hawk by the United States navy will prevent the work from being undertaken the present season.

H. C. Bumpus.

ZOOLOGICAL NOTES.

PUBLICATIONS OF THE AMERICAN MUSEUM OF NATURAL HISTORY.

The Report of the American Museum of Natural History, New York, for 1897, re-

cently issued, has for its frontispiece a view of the south front as it will appear when the work on the east and west wings, now in progress, is completed. This front will have a length of 700 feet and, great as it will be, the area covered is only about a third of that planned for the finished structure. This will afford room for growth for many years to come, without any crowding of the collections, and it is small wonder that the American Museum, with its spacious exhibition halls, laboratories and offices, is at once the admiration and envy of other institutions.

Other illustrations in this report are views of collecting parties at work in Nebraska, and some of the mounted specimens in the paleontological hall. Although the Department of Vertebrate Paleontology has been organized but seven years, this hall already contains what is probably the most impressive exhibit of fossil vertebrates in the world, and while the beauty of Mr. Hermann's preparations can be readily appreciated by the average visitor the plylogenetic arrangement of the collections is of great interest to the student.

The American Museum has also issued an illustrated catalogue of casts, models, photographs and restorations of fossil vertebrates which are to be had in exchange or, in certain cases, are for sale. The statuettes of Mr. Knight are extremely good and show the great advance that has been made in our knowledge of extinct forms since Waterhouse Hawkins perpetrated his flights of fancy for the Crystal Palace. Of course, it may be said that he had little or no data on which to base his 'restorations,' but it would seem better, under the circumstances, not to have attempted them at all, on the ground that it is better 'not to know so much than know so many things that ain't so.' The most striking and vigorous of Mr. Knight's restorations is probably the one most open to criticism, but there are many who will hesitate to accept without reserve the form and attitudes ascribed to *Megalosaurus* (*Lælaps*) *aquilunguis*.

F. A. L.

CURRENT NOTES ON METEOROLOGY

THE CLIMATE OF THE PHILIPPINES.

THE climatic conditions of the Philippine Islands are just now attracting considerable attention, and brief notes, usually very general in character, concerning these conditions are finding their way into print. The 'Philippine Number' of the *National Geographic Magazine* (June) contains an article by F. F. Hilder (also published, substantially unchanged, in the *Forum* for July), two pages and a-half of which are devoted to the climate of the Philippine group of islands. The seasons at Manila are described by the Spaniards as

> "Seis meses de lodo,
> Seis meses de polvo,
> Seis meses de todo;"

six months of mud, six months of dust and six months of everything. Other brief notes are found in *Scribner's Magazine* for June, in an article on 'Manila and the Philippines,' by Isaac M. Elliott, formerly U. S. Consul at Manila, and in the *American Monthly Review of Reviews* for June, in an article by J. T. Mannix, entitled 'Notes on the Philippines.'

There is much confusion in the public mind just now as to the question of the health of North American troops during a temporary sojourn in the Philippines, and also as to the larger question of possible acclimatization of our people in those islands, in case of permanent occupation. No definite answers can be given to these two questions, but in their consideration three things may well be borne in mind. *First:* By means of a strict observance of hygienic principles, the death rate among foreigners in a tropical country can be very

much reduced. This has been nowhere better shown than in the case of the British troops in India and of the French troops in Cochin-China. *Second:* The great majority of the best authorities are agreed that complete acclimatization of Europeans (and hence, we may add, of North Americans) in the tropics is impossible. By exercising the greatest care, they may *live* in tropical countries, but, as has been well said by a recent writer, to tolerate a climate is one thing; to be independent of it is quite another. *Third:* The Anglo-Saxons are universally acknowledged to be the least fitted, the Mediterranean nations the best fitted, to colonize in the tropics.

MONTHLY WEATHER REVIEW FOR APRIL.

The April number of the *Monthly Weather Review* contains several articles of general interest. In an account of 'A Visit to the Highest Meteorological Station in the World,' R. DeC. Ward describes his experiences on two trips to the summit of El Misti (19,200 ft.), near Arequipa, Peru, where the Harvard College Observatory maintains a meteorological station which is at present, and is likely to be for some time to come, the highest in the world. In 'Meteorological Work in Alaska,' A. J. Henry, Chief of the Division of Records and Meteorological Data of the Weather Bureau, gives an account of the recent observations that have been made in that Territory. Two papers by A. Lawrence Rotch concern 'The International Aëronautical Conference,' recently held at Strassburg, and 'The Eighth General Meeting of the German Meteorological Society.' Professor Cleveland Abbe, the editor of the *Review*, contributes articles on 'The Rainfall and Outflow of the Great Lakes,' 'Lightning on the Kite Wire,' and other matters.

SONNBLICK VEREIN.

The sixth *Jahresbericht* of the Sonnblick Verein, a society which has for its object the maintenance of the now famous meteorological observatory on the Sonnblick, contains an appreciative account, by Dr. von Obermayer, of Dr. Jacob Breitenlohner, who had much to do in the original planning of the observatory on the Sonnblick; an account of the medal given to Dr. Hann on his retirement from active service in Vienna; the meteorological summaries for 1897 (for Sonnblick and Rauris), and a report of the annual meeting of the Verein. Several changes and improvements have been made during the year, the most important of which is the establishment of a new base station, connected by telephone with the summit and with the Rauris station. At this new station observations were begun on January 1st of this year.

NOTES.

Dr. Hann contributes another noteworthy publication to the valuable series of meteorological discussions which have appeared in the *Sitzungsberichte* of the Vienna Akademie der Wissenschaften. The present report is entitled *Weitere Beiträge zu den Grundlagen für eine Theorie der täglichen Oscillation des Barometers*, a subject to which the author has already given much study. The data used in this investigation come from many different sources, and from widely scattered regions, and are analyzed with Dr. Hann's customary accuracy and care.

On the *Pilot Chart of the North Pacific Ocean* for July there is reprinted, from the Report of the Director of the Hongkong Observatory for 1897, a classification of typhoons, based on the seasons of the year and the regions in which these disturbances occur. This classification is of special interest at the present moment.

R. DeC. Ward.

Harvard University.

CURRENT NOTES ON ANTHROPOLOGY.

LATER CRIMINOLOGY.

A FEW years ago most of us had considerable faith in Lombroso's 'criminal type.' We looked at ear-lobes and finger-nails, and thought we detected in them the 'stigmata of degeneration.'

This illusion was lost when it was found that in fact the criminal was about as well formed as the jury or the Judge. The 'criminal type' fell into oblivion.

But the 'criminal mind' remained. The psychology of evil doers must have something in it radically different from that of 'respectable people.' We forgot the force of the Rev. John Newton's saying, when he saw a thief led to the gallows: "There goes John Newton, but for the grace of God."

Now, however, such authorities as Näcke and Baer and Dallemagne have pronounced the whole edifice of 'criminal psychology' a phantom and a delusion. Criminals are just like other people of their sex, age and condition in life. They are tempted, fall and are caught (especially the last), and that is the only difference.

Such is the summary of the case in the Centralblatt für Anthropologie, 1898, Heft II.

THE DELUSION OF 'ATAVISM.'

'ATAVISM,' or 'reversion,' in the dialect of the evolutionist means a recurrence to a more or less remote ancestral type, and in theory it is brought about through the 'immortality,' as it has been boldly called (by Lapouge), of the germplasm (*Keimplasma*).

Some years ago (1894) I urged in a paper before the American Association that most so-called reversions in the human skeleton have other and better explanations. Now comes a Dutch physician, Dr. Kohlbrugge, and maintains that all alleged atavistic anomalies are merely neutral variations due to ordinary causes (mal-nutrition, use, disuse, etc); and, as they vary from a mean in one direction or the other, they assume a deceptive appearance of regressive or progressive variation, the former reaching to what has fallaciously been considered reversion and atavism. For this he brings considerable evidence. This book is published at Utrecht by Scrinerius, and is well reviewed in the Centralblatt für Anthropologie, 1898, Heft. 2.

ORIGIN OF THE CLIFF DWELLINGS.

IN the *Bulletin* of the American Geographical Society, No. 2, 1898, Mr. Cosmos Mindeleff has a thoughtful article on the origin of the cliff dwellings.

He shows with satisfactory clearness that they are 'the direct result of the peculiar geographic environment.' Like the Pueblos, they are completely adapted to the country in which they are found. Only the 'kivas' or estufas may be regarded as a transplanted feature. These are 'undoubtedly a survival from the time when the people lived in circular lodges, like the Navahoes of to-day.' Many of the sacred ceremonies could be properly performed only in a circular chamber. The cliff ruins exhibit a long sequence of time, but not a development.

He concludes with the general maxim: "The study of an Indian art is the study of the conditions under which it was developed."

In this connection I should mention a carefully prepared article in the *American Anthropologist* for May, by Walter Hough, on 'Environmental Interrelations in Arizona.'

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

SCIENTIFIC NOTES AND NEWS.

EXTENSION OF THE WEATHER SERVICE.

THE Weather Bureau has decided to make an important extension of its service by establishing ten or more stations on the Caribbean

Sea. It is expected that a central station will be established in Jamaica or Cuba which will be under the direction of Professor Mark Morrill, now at Washington, and W. B. Stockton, now at Cleveland. Stations will probably be situated on Barran Quilla, Columbia, St. Kitts (southeast of St. Thomas), Trinidad, Curaçao, Martinique, San Domingo and the Barbadoes, and on the north coast of South America. Among those who it is expected will be assigned to these stations are Messrs. Franklin G. Tingley, of Indiana; John W. Towers, of New York; Thomas Crawford, of Jacksonville, Fla.; Frank A. Davis, of Philadelphia; Louis Dorman, of Pittsburgh, and John M. Ryker, of Galveston.

It is planned to make weather charts for the region extending from Central America to the Caribbean islands and from the southern coast of North America to the northern coast of South America. Reports, forecasts and warnings will be sent out to the central station and thence to Washington, whence they will be distributed wherever needed. In cases where indications of an approaching tornado occur the observers will be empowered to send out telegraphic warnings at intervals of two hours, so that a place within the path of the tornado will have ample time to make preparations before the actual arrival of the storm. It is hoped by this means to aid and safeguard the important commercial undertakings which are being rapidly built up in the region.

THE SPECTRUM OF METARGON.

Professor Arthur Schuster writes to *Nature* that in the account given by Professor Ramsay of his researches on the 'Companions of Argon' he has omitted to draw attention to a very curious similarity between the spectrum of his new gas 'metargon' and the ordinary spectrum of carbon, with which every student of spectrum analysis is familiar.

The following comparison of wave-lengths will make the similarity apparent:

		Ramsay's metargon.		Carbon (Angström and Thalén.
Citron band	1	5632·5	...	5633·0
	2	5583·0	...	5583·0
	3	5537·0	...	5538·0
Green band	1	5163·0	...	5164·0
	2	5126·5	...	5128·0
Blue band	1	4733·5	...	4736·0
	2	4711·5	...	4714·5
Indigo band		4314·5	...	4311·0

There are three of Ramsay's bands not included in this list, but these are nearly coincident with known bands in the cyanogen spectrum.

It seems hardly credible that Professor Ramsay has not guarded against the possibility that all these bands may be due to carbon, and not to a new gas; but some explanation seems required, for, though the coincidences in the two sets of bands is not complete, there is no case known in which two different elements have spectra so nearly alike as those of carbon and metargon seem to be.

THE BRITISH GOVERNMENT AND ANTARCTIC EXPLORATION.

We have on several occasions called attention to the efforts made by the Royal Geographical Society and the Royal Society to obtain the cooperation of the British government in sending an expedition for the exploration of the Antarctic Continent and Ocean. We regret to learn that the government has declined to undertake to make itself responsible for the expedition. The official letter addressed by Sir Clements Markham to Lord Salisbury on October 26, 1897, has just been made public. In its course Sir Clements says:

Last year, under instructions from the Council of the Royal Geographical Society, I brought the matter to the notice of the First Lord of the Admiralty, as it was felt that such an expedition should be a naval expedition, in accordance with all precedents. A reply was received, dated the sixth of April last, to the effect that the Lords Commissioners of the Admiralty regret to be unable to take any part in the organizing of such an expedition, but that at the same time they regard the enterprise as one which is important in the interests of science. Although the present exigencies of the naval service prevent their lordships from lending officers, they will watch the result with great interest, and will be prepared to aid in other ways.

Great regret will be felt throughout the country that the navy should be deprived of the conduct of enterprises of this character, which have always belonged to it from the days of Anson, and from the results of which not only the naval service and the

country, but the whole civilized world, have derived benefit.

But this unfortunate inability, caused, in the opinion of their lordships, by the exigencies of the present time, does not preclude the despatch of an Antarctic expedition under the sanction and authority of her Majesty's government, led by competent seamen and scientific persons who could perform this difficult service satisfactorily.

Grants from the Treasury for such purposes have been so frequent that they may be considered as part of the public policy of the country. To mention those only which were directly connected with this Society, there were the grants in aid for the expeditions of Schomburgk, of Burton, of Speke, of Livingstone, of Cameron, and, more recently, the grant of £1,000 in connection with Mr. Leigh Smith's Arctic expedition. * * * An Antarctic expedition would be most efficiently conducted if the funds were supplied and the details were organized by the government, perhaps through the agency of a specially appointed committee. At the present time, even apart from naval officers, there are scientific seamen and travelers of experience known to myself and my Council who would form a capable staff. My Council trusts that such an arrangement will secure your lordship's approval. An alternative course would be that, with the aid of grants from the Treasury and the governments of the Australasian colonies, the Council of this Society should undertake the responsibility of equipping and despatching the expedition.

The final reply from the Foreign Office, dated Jnne 9, 1898, says:

That after carefully consulting the authorities at the Treasury and the Admiralty, Lord Salisbury is unable, under existing circumstances, to hold out any hope of the government embarking upon an undertaking of this magnitude. Lord Salisbury has made inquiry through the Secretary of State for the Colonies as to the attitude of the Australasian colonies towards the proposal for further Antarctic exploration; and he is informed that at the recent Conference of Premiers held at Melbourne in March last it was resolved that those colonies should take no joint action in the matter; and the cooperation anticipated by the Society from that quarter will not apparently be afforded by the colonial governments.

The Royal Geographical Society will now endeavor, without the aid of the British government, to obtain the funds for an expedition to be sent out under the Society's auspices. They have authorized the President to take steps to obtain subscriptions to the amount of not less than £50,000; the Society itself contributes £5,000.

PROFESSOR KOCH ON THE PLAGUE.

PROFESSOR KOCH was the guest of the German Society for Public Hygiene on July 7th, and delivered an address on the subject of the plague, in which he dealt especially with his discovery of a plague center in the *Hinterland* of German East Africa, whither the disease had been introduced from Uganda. According to the report in the London *Times* he gave a survey of the recent epidemics in Mesopotamia, Persia, China and India, which pointed out that the view entertained ten years ago that the plague was no longer a danger to the nation was shown to be untenable.

A rich harvest of results had been reaped from the study of the plague with the aid of modern means of investigation. The disease had been demonstrated to be caused by bacteria, and useful lessons had been drawn regarding the best methods of combating its ravages. There were excellent prospects of progress in the direction of creating artificial immunity. The part played by rats in the dissemination of the plague has been elucidated, so that it might be said that the plague was really a rat disease. One question, however, to which a satisfactory answer had not yet been given related to the ultimate origin of the disease. The old explanation that it was found wherever dirt and social misery prevailed was inadequate. There must be places where it was endemic and whence it was transplanted into districts that had hitherto been free from infection Former outbreaks could be traced back to Mesopotamia, where the plague had never entirely disappeared. But whence came the Chinese plague? It could be proved that its endemic center was in Hunan. Tibet was a second center, and the latest outbreaks in China, as in India, had their origin there. The third center was on the west coast of Arabia, in the vicinity of Mecca. This center had a special importance in view of the numerous pilgrims who visited it, but it was, after all, doubtful whether the plague was endemic in the neighborhood of Mecca. The constant cases which occurred there might only be survivals of the disease as introduced by large masses of people from abroad. Nothing had hitherto been known of any other plague center besides these enumerated, but Professor Koch

now claimed to have discovered a fourth center in Equatorial Africa. It had been found that a devastating disease prevailed at Kissiba, in the extreme northwest corner of German East Africa, close to the Victoria Nyanza. Suspecting that it was the plague, Professor Koch proceeded from India to East Africa, in order to make investigations. With the help of Dr. Zupitza, who made a special expedition to Kissiba, he had been enabled to identify the disease as the bubonic plague. In the case of five persons who had died from the disease anatomical preparations were obtained and the blood and lymphatic glands of plague-stricken patients were bacteriologically examined. All the ordinary features of the bubonic plague were present. Nine out of ten of those who were infected died. The disease was communicated to rats and to monkeys. It was found that an outbreak of the plague among rats frequently preceded a human epidemic, and, in fact, the rat plague might always be regarded as a warning.

GENERAL.

We learn with much regret that on the ground of ill health Sir William Flower has resigned the directorship of the Natural History Museum, London.

The Berlin Geographical Society has elected as honorary members Professor W. M. Davis, Mr. G. K. Gilbert, M. A. de Lapparent and Professor H. Mohn.

The University of Michigan has conferred the degree of LL.D. on Dr. A. Jacobi, clinical professor of the diseases of children in Columbia University.

Hamilton College has conferred the degree of Sc.D. on Mr. William R. Brooks, Director of the Smith Observatory, at Geneva, N. Y.

Dublin University has conferred *honoris causa* the degree of Sc.D. on Mr. Robert Henry Scott, Superintendent of the Meteorological Department in London.

We regret to record the death of Professor Anton Kerner, Ritter von Marilaun, the eminent botanist, professor in the University of Vienna.

Mr. Alexander Whyte has been appointed, by the British government, scientific adviser in Uganda, where he will establish a botanic garden and experiment station.

Mr. E. B. Dunn, Local Forecaster of the Weather Bureau, in New York, has resigned the position, which he has held for the past fifteen years; Mr. Eben H. Emery has been appointed his successor. Mr. Emery is a graduate of Bates College, and has been connected with the weather service for fourteen years. During the past four years he has been First Assistant in New York, and his promotion is in accordance with the principles of civil service reform.

Dr. Oswald Lohse, of the Astrophysical Observatory in Potsdam, has been promoted to the rank of a professor.

Professor D. G. Ritchie, of St. Andrews, has been elected President of the Aristotelean Society, London.

The Epidemological Society of London has made the first award of its Jenner Medal to Mr. William Henry Power, F.R.S., Senior Assistant Medical Officer of the Local Government Board.

The Physico-agricultural Society, which in 1798 removed from Mohrungen to Königsberg, offers in commemoration of the centennial celebration a prize, the cost of which is defrayed by Dr. Walter Simon. The subject proposed is a research on 'Animal or Plant Electricity' and the value of the prize is 4000 Marks. The competition closes on December 31, 1900, and is open to citizens of any country. The essays may be written in German, French, English or Italian and may be published at any time after September 30th, of the present year.

At a meeting of members of the Royal Institution on July 6th special thanks were returned for the following donations to the fund for the promotion of experimental research at low temperatures: Mrs. G. J. Romanes, £5; Sir Frederick Bramwell, £100; Professor Dewar, £100; Dr. Ludwig Mond, £200; Mr. Charles Hawksley, £100; Sir David Salomons, £21; and Dr. Rudolph Messel, £100.

Sir Robert Rawlinson, formerly Chief Engineer Inspector of the London Local Government Board, who died on May 28th, aged 88 years, bequeathed £1,000 to the London Insti-

tution of Civil Engineers. He also left a large sum, apparently about £35,000, to St. Thomas Hospital, London.

THE International Congress of Zoology, which opens at Cambridge on August 22d, will be divided into four sections: (a) General Zoology; (b) Vertebrata; (c) Invertebrata (except the Arthropoda); (d) Arthropoda. There will be two general discussions, one on 'The Origin of the Mammalia,' opened by Professor Osborn and Professor Seelye, of London, and one on 'The Position of Sponges in the Animal Kingdom,' opened by Professor Delage, of Paris, and Mr. Minchin, of Oxford.

WE are requested to state that it has been agreed by the Executive Committee that ladies attending the Fourth International Congress of Zoology at Cambridge in the company of a member may become associates on the payment of 10s. This payment shall entitle them to attend the general and sectional meetings, and the receptions held during the meeting of the Congress at Cambridge. An associate's ticket shall not be transferable and shall not entitle the holder to receive a copy of the final report.

AT the Washington meeting of the National Educational Association the Natural Science Department received reports from the several committees of twelve charged with the preparation of a course in science for the secondary schools. The subjects considered are physics, chemistry, physical geography, zoology and botany. The committees represent the Natural Science Department of the National Educational Association, the American Association for the Advancement of Science, and the several Associations of Colleges and Preparatory Schools. The chairmen for the five subjects were appointed as a committee to correlate the reports and to present, as soon as practicable, a matured scheme of science instruction for the schools. The chairmen are: for physics, Professor E. H. Hall, of Harvard; for chemistry, Professor Alexander Smith, University of Chicago; for physical geography, Professor Albert Perry Brigham, Colgate University; for zoology, Professor H. B. Ward, University of Nebraska; for botany, Professor J. M. Coulter, University of Chicago.

THE Russian Association of Naturalists and Physicians will hold its tenth meeting at Kief during the last week in August.

THE Ninth Congress of French Alienists and Neurologists will open at Angiers on August 1st, under the presidency of Dr. Mottet. The Fourth French Congress for the Study of Tuberculosis from the 27th of July to the 1st of August, under the presidency of Professor Nocard.

THE Sixteenth Congress of the Sanitary Institute will be held at Birmingham, England, from September 27th to October 1st, under the presidency of Sir Joseph Fayrer. There will be three sections: (1) sanitary science and preventive medicine; (2) engineering and architecture, and (3) physics, chemistry and biology. There will also be special conferences and an exposition. Dr. Christopher Childs will lecture before the Congress and Dr. A. Hill will give a popular lecture.

A PROPOSAL has been made by the Bombay Medical and Physical Society to hold a congress at Bombay at the beginning of the winter to make a thorough study of the plague.

THE Mining Congress, in its recent session in Salt Lake City, has adopted a memorial to Congress asking for the creation of a department of mines and mining. The next meeting of the Congress will be in Milwaukee, beginning September 7, 1899.

MAYOR VAN WYCK, of New York, has made a statement before the Board of Estimates stating that he is not opposed to the Public Library, the Botanical and Zoological Gardens and the Museums, but he thinks that they should be owned and controlled by the city. He stated that he would favor appropriating $15,000,000, if necessary, for a public library. A few weeks ago, however, the Mayor said that the $150,000 needed to prepare the site for the new public library could not be given because the city had exceeded its debt limits. The construction of the library was authorized before the present administration came into office, and it is to be hoped that the money already appropriated cannot long be withheld.

THE Committee of the House of Commons on the Museums of the Science and Art Department has recommended, as we have already

mentioned, the removal of the Museum of Practical Geology from Jermyn street to South Kensington. Many protests have been made against this plan and a memorial signed by about 500 members of the Geological Society has been presented to the government urging serious objections to it.

It is stated in *Nature* that the fourteenth annual general meeting of the Marine Biological Association was held on June 28th; Professor E. Ray Lankester, F.R.S., President, being in the chair. The Report of the Council dealt largely with the work done at the Plymouth Laboratory during the year. Reference was made to Mr. Garstang's investigations of the habits and migration of the mackerel; to Mr. Holt's researches on the reproduction and development of fishes living in the neighborhood of Plymouth, and their distribution at different ages; as well as to the experiments with floating bottles for determining the surface drift in the English Channel, and to the systematic investigation of the dredging and trawling grounds between the Eddystone and Start Point. Twenty-two naturalists and eight students were reported as having worked at the Laboratory since the last annual meeting, in addition to the members of the regular staff. The following were elected members of Council for the year: President, Professor E. Ray Lankester; Hon. Treasurer, J. A. Travers; Secretary, E. J. Allen. Council: F. E. Beddard, Professor Jeffrey Bell, G. C. Bourne, Sir John Evans, G. H. Fowler, S. F. Harmer, Professor Herdman, Professor Hickson, J. J. Lister, Sir John Murray, P. L. Sclater, D. A. Scott, Professor C. Stewart, Professor W. F. R. Weldon.

It will be remembered that sometime since Baroness Hirsch presented 2,000,000 fr. to the Pasteur Institute, Paris. It has been decided to use this sum for the construction and maintenance of a biological institute, which shall be placed opposite the Pasteur Institute, on the rue Dutot. M. Duclaux will be Director of the new Institute, while M. Gabriel Bertrand will have charge of the laboratories of physiological chemistry.

The Academy of Medicine of Paris has for forty years had no home, says the New York *Medical Record*, its meetings being held in the old chapel of the Charité Hospital. It owns ground near Luxembourg, which the government has appropriated for a school of chemistry. In compensation for this lot the French legislature has appropriated a sum sufficient for the purchase of a site for a building on the rue Bonaparte. On this ground the Academy will soon erect a suitable building, where its meetings can be held and which then will be used for storing transactions, for the library, or for the various departments which are under the care of the Academy—for instance, the vaccination department, the board in charge of prophylaxis and treatment of epidemic diseases, the board to which is intrusted the care of the various mineral springs, the sanitary and statistical departments, and the office for dealing with awards granted for sundry scientific researches.

We learn from the London *Times* that the Lord Mayor of Liverpool opened on July 4th another institution in connection with University College in that city. This is Ashton-hall, a museum and school of hygiene. The building was presented by the late Mr. George Holt, and remodeled with funds provided by Mrs. and Miss Holt and the Technical Instruction Committee. It is a large building, with well-lighted museum, laboratories and lecture room, the latter fitted with an electric air lamp. The museum rooms are well fitted, and are already stocked with numerous useful exhibits. The opening ceremony took place in the Arts Theatre of University College, under the presidency of Councillor Willink, Chairman of the Sanitary Science Instruction Committee. Dr. E. W. Hope said it was the late Mr. Holt's wish that the building should be devoted to some branch of medicine having for its object the promotion of public health, and the medical faculty of the College thought they would be giving effect to his wishes by using the building for a museum and school of instruction in public health matters and for research in subjects connected therewith. The building was well equipped for these purposes, including investigation of advanced sanitary problems, such as the purification of water and sewage, the action of disinfectants, and so forth. The

Lord Mayor said that, though it had only been in use a few months in the training of students who wished to become sanitary inspectors, 14 young townsmen had passed the examination and in due course would get certificates and be qualified to act as sanitary inspectors.

THE Select Committee on the Museums of the Science and Art Department, met again on July 5th, as we learn from the London *Times*, and made further progress with the consideration of their report. Certain paragraphs of a recommendatory character were postponed; but the portion of the Chairman's draft dealing with the origin and development of the several museums which remained to be discussed was finally disposed of, and when the Committee reassemble they will proceed at once to formulate their conclusions. Although the question of recommendations has yet to be dealt with, Sir Francis Powell's draft report has already undergone considerable alteration, not the least important of the amendments accepted by the Committee being one relating to the Bethnal-green Museum (submitted by Sir Mancherjee Bhownaggree) declaring that, inasmuch as no arrangement has been made to provide technical instruction in connection with this institution, the object of its inception remains unrealized. The official records show that the Bethnal-green Museum was established to provide for the working population of the East End adequate means of instruction, and that promises were repeatedly given that a school of science and art with a library attached should be started. The complaint from the locality is that no attempt has been made to redeem these promises.

A LETTER has been received by the London School Board from the London County Council stating that the Parks and Open Spaces Committee had considered the Board's letter of May 24th last, which enclosed an extract from a report from the British Embassy at Berlin, as to the arrangements in force in that city for facilitating the study of botany, and which asked the Council whether a somewhat similar arrangement could not be made in London. The County Council informed the Board that they were taking steps in this direction by forming a series of beds in Battersea, Ravenscourt and Victoria Parks, with specimens of plants in their natural orders, and added that the Parks Committee thought that it would be desirable to see the result of this experiment before proceeding any further for the present.

'A REVISION of the Genus Capsicum, with especial reference to garden varieties,' is the title of an article by Mr. H. C. Irish in the last report of the Missouri Botanical Garden. From it we learn that some years since, Dr. Sturtevant, then of the New York Agricultural Experiment Station, planned a systematic study of the *Capsicum*, from an agricultural rather than a strictly botanical standpoint, and, his material, notes and library having been subsequently presented to the Missouri Botanical Garden, for some years past all procurable varieties of this polymorphic genus have been grown in St. Louis and made the subject of current study. In the present paper Mr. Irish, the Horticultural Assistant at the Garden, brings together the result of this study, prefacing the systematic portion by a general account of Capsicums and their uses. A minutely divided analytical key to the garden peppers is provided, and in the synopsis these are all arranged under two species, *C. annuum* and *C. frutescens*, the several botanical and many horticultural varieties of which are described in considerable detail. An unusual feature, for a horticultural paper, is the very large citation of references, especially to early literature, many of which were accumulated by Dr. Sturtevant, and in the verification of which the magnificent pre-Linnæan library which he brought together has been invaluable. All of the principal varieties are represented in simple but effective outline drawing. Mr. Charles Henry Thompson, who last year published a study of the Wolffiellas of the United States, contributes to the *Report* a careful revision of all of the Lemnaceæ occurring in the United States, in which analytical keys and good illustrations are provided for the ready determination of the species.

A CIRCULAR has been issued by The Bureau of Mines, Toronto, stating that the first discovery of Corundum in Ontario was made late in the

year 1896, and exploration work carried on under direction of the government in 1897 shows that the Corundum-bearing lands have an aggregate area of about 50,000 acres, lying in the townships of Carlow, Bangor, Raglan, Radcliffe, Brudenel, Lyndoch and Sebastopol, in the counties of Hastings and Renfrew. The mineral rights over nearly the whole of this tract are held by the crown, and they have been withdrawn from sale and lease pending a report on the occurrence of the mineral and the methods of treating it, undertaken by the professors of the Kingston School of Mining. This report and a map of the Corundum region has been published, and copies of it may be had on application to the Bureau of Mines, Toronto. The attention of prospectors, miners and capitalists is invited to the district, and, with a view to its development and the establishment of industries in the Province for treating and utilizing the Corundum ore, proposals will be received until the first day of September next. Preference in the selection of mineral lands will be given to parties who will undertake to conduct mining and treating operations on the largest and completest scale, and who can furnish satisfactory assurances that they possess the requisite capital for the proposed operations, including separation of the ore from its gangue, milling for abrasive uses, manufacture of abrasive goods, and the production of aluminium if the ore is suitable therefor. Waterpower of large capacity is available in the locality for electrical and other works; and during the summer season the lands are easily accessible by steamboat from Barry' Bay station, on the line of the Ottawa, Arnprior and Parry Sound Railway. The lands will be disposed of under the leasehold system, renewable for fixed periods indefinitely at a low rental, subject to the performance of working conditions as provided in the regulations governing the same.

We learn from *Natural Science* that the Trustees of the British Museum have recently purchased the large collection of marine animals formed by Canon A. M. Norman, and containing type-specimens of many species which he has established. Part of the collection is already in the Museum; the rest will go there eventually. The Edinburgh Museum of Science and Art has recently acquired the valuable collection of fossils from the Upper Silurian rocks of the Pentland Hills, made by the late David Hardie, of Bavelaw. It is especially rich in specimens from the Eurypterid beds of Gutterford Burn, near Carlops, Peeblesshire; there are also specimens, chiefly sponges, from North Esk.

In view of the importance of photography for scientific expeditions Mr. W. J. Stillman writes to the London *Times* on experiments made by him, demonstrating the advantage, of using 'cut-films' of celluloid as a substitute for glass. These films are shavings, about the fourth of a millimeter in thickness, from a solid block of celluloid, practically not breakable, and lying flat in the holder like glass. Mr. Stillman writes as follows: "Considering the extreme portability and infrangibility of these films and their inestimable superiority in these respects over glass, and in other respects over paper, I think that these experiments have a high value for scientific voyagers, to whom photographic illustration is so important and the difficulties of photographic operation *en voyage* are so great. *A priori*, as the celluloid is produced under the action of strong acids, and has a certain tendency to liberate the acids with time, their action tending to cause insensibility in the haloid which holds the photographic image, I believed that in so long a time as is covered by my experiment they would have become quite insensible, but I did not see that in this respect there was much falling off. A little there probably is, for in the case of films of the highest sensibility I have found that impressibility for all practical purposes had disappeared after a year, those of lower sensibility losing less in proportion; but this is of absolutely no moment, exposure in the camera for a second more or less being a matter of no importance. The fact that a traveller may with this portable and unbreakable material spend years in the most difficult explorations with photographic record possible at all stages, and develop it on his return home, ought to be of scientific import."

Technical inventions naturally lead to the invention of new names, but rarely in such variety as the following synonyms, for all of which we cannot, however, vouch, collected by

a daily paper: Vitascope, kinetoscope, phantoscope, criterioscope, cinematograph, biograph, kinematograph, wonderscope, animatoscope, vitagraph, panoramograph, cosmoscope, anarithmoscope, katopticum, magniscope, zeoptrotrope, phantasmagoria, projectoscope, variscope, cinograph, cinomograph, hypnoscope, centograph, x-ograph, electroscope, cinagraphoscope, craboscope, vitaletiscope, cinematoscope, mutoscope, cinoscope, animaloscope, theatograph, chronophotographoscope, motograph, kinetograph, rayoscope, motorscope, kinetinephone, thromotrope, phenakistoscope, venetrope, virtescope, zinematograph, vitopticon, stinetiscope, vivrescope, diaramiscope, lobsterscope, cormonograph, kineoptoscope.

UNIVERSITY AND EDUCATIONAL NEWS.

DR. E. BENJAMIN ANDREWS, President of Brown University, has been elected Superintendent of the Chicago Schools by the Board of Education. Thirteen votes were cast for Dr. Andrews and six for Albert G. Lane, the present Superintendent. Dr. Andrews will accept, and will assume the duties immediately. Professor Benjamin Ide Wheeler, who holds the chair of Greek at Cornell University and is an alumnus of Brown University, is prominently mentioned in connection with the vacant presidency.

PROFESSOR JOHN M. COULTER, head of the department of botany in the University of Chicago, is Principal of the Winona Assembly and Summer School, which is holding a session from July 4th to August 28th. The buildings and grounds have been fitted up at a cost of about $300,000.

THE sixth volume of the *Annual Register* of the University of Chicago is a book of 480 pages. The summary of attendance shows a total enrollment for the year of 2,307 students, 1,428 men and 879 women. By quarters the figures are:

Summer, '97,	1273
Autumn, '97,	1170
Winter, '98,	1169
Spring, '98,	1094

THE enrollment of students in the University of Nebraska for the year 1897–98 was as follows:

Graduate students,	143
Collegiate students	993
Law students,	102
Special professional students,	30
Agricultural and mechanical school,	36
School of art and music,	325
Preparatory school	190
Summer school	262

Deducting duplicated names there were 1915 in all, of which 1,043 were men and 872 women. The instructional staff and assistants numbered 184.

Two hundred and fifty students were enrolled in the summer session of the University of Nebraska, June 6th to July 16th. Hitherto this has been a semi-independent summer school, but this year the experiment was made of offering condensed courses of regular University work. By more frequent meetings of classes and more hours per week in the laboratories, as much was accomplished in many subjects in six weeks as in a full semester under ordinary conditions. The success of the summer session just closed encourages the University authorities to continue the experiment next year. Fully sixty-five per cent. of the students in this session were teachers in the schools of the State.

IT has been ordered by the Russian Minister of Public Instruction that the number of Jewish students in any faculty of the University of Moscow shall not exceed three per cent. of the total number of students in that faculty.

THE Egyptian Ministry of Public Instruction advertises for a senior and a junior professor of agriculture for the School of Agriculture, Gheezeh. The salaries are about $2,500 and $1,500 per annum. Applications may be made before August 12th to the Principal of the School, W. C. Mackenize, D.Sc., 6 Hartington Gardens, Edinburgh.

IN the absence of Mr. W. H. R. Rivers, who is accompanying Professor Haddon on his expedition to the Torres Straits, courses in experimental psychology in University College, London, will be given by Mr. E. T. Dickson.

DR. WILLY KUNKELTHAL, associate professor of zoology at Jena, has been called to a full professorship in Breslau; Dr. F. J. Becker, professor of mineralogy in the German University at Prague, has been called to Vienna.

Dr. Georg Karsten, docent in botany in Kiel, Dr. Richard Abegg, docent in physical chemistry at Göttingen, and Dr. Böhming, docent in zoology at Gratz, have been promoted to associate professorships. Dr. Reitzenstein has qualified as docent in chemistry at Würzburg and Dr. Simon as docent in physics in Göttingen.

DISCUSSION AND CORRESPONDENCE.

SUBSTITUTIONAL NERVOUS CONNECTION.

In a series of recent papers the writer has endeavored to show that the idea now apparently dominant that, with the single exception of the olfactory, the peripheral nervous connections are indirect rather than direct is an unwarrantable assumption. It has been found possible to demonstrate in the skin termini of nerves which are, so far as can be seen, unimpeachable instances of connection by continuity. These are then of the same nature as the connections of the olfactory cells with the fibres of the olfactory nerve. On the other hand, it appears that some of the most careful observers have detected simliar rod-cells with special nervous functions which are only in indirect communication with the nerve which conveys the stimulus. If it could be shown that the sensory cells are uniformly without nervous processes it might be assumed that they constitute by themselves a special class of nervous organs which normally do not acquire the neurite, but the admitted existence of such a process of the olfactory cells and the fact that these cells are otherwise so similar to the other instances of nervous endings, in which it seems to be proved that this sort of direct connection is absent, prevents the possibility of establishing such an independent class of structures. Still more, if our own observations are taken into account, it seems necessary to offer some other suggestion to account for the discrepancy in this particular. Take, for illustration, the case of the organs of taste, which, in spite of their evident resemblance to the olfactory termini, are generally stated to have only indirect nervous connections. I have elsewhere suggested the possibility that in the case of these sense organs the original proton is to be found in the same paired bands of cells from which the olfactory epithelium is derived. It is admitted that to these other elements have possibly been added by way of the gill clefts, but it seems only natural to suppose that the palatal portion, at any rate, may have had the origin suggested. If this were so, it is evident that there is no relation between the position of the peripheral proton and the source of the nerves supplying these organs. It might be suggested, therefore, that the original nervous communication having been lost, the new connection has been established in a secondary manner by the apposition of what at one time were free termini between the cells to these specialized cells. If the illustration chosen appears far-fetched, a more general illustration will indicate still more clearly the application of theory proposed. There can be no doubt that, on any theory of evolution of the higher vertebrates from the lower, a difficulty arises in the attempt to construe the fact that the lateral line organs with their homologues and allies do not seem to obey a constant law of nervous supply, while in the higher vertebrates it is difficult to follow the transformations which these organs have undergone. It is possible that these difficulties will largely disappear if the probability be admitted that, in the course of evolution, the original connections have been lost or diverted and that new ones have then been established by the application of some of the free nerve endings to the cells thus deprived of their original nervous connections. That some such changes have taken place seems to the writer more than probable. If this be admitted, it is not to be wondered at that in the lower vertebrates especially the two sorts of endings may be encountered side by side in different parts of the skin. It is not the present intention to enlarge on or illustrate this thought, which is thrown out in the hope that the suggestion may prove fruitful in the hands of others.

C. L. Herrick.
University of New Mexico.

THE EXHIBITION OF CETACEANS BY PAPIER MACHÉ CASTS.

To the Editor of Science: Mr. F. A. Lucas calls my attention to the following passage in an editorial notice of the new Cetacea Gal-

lery in the British Museum, in the July number of *Natural Science* (p. 10):

"No museum has hitherto solved the difficulty of exhibiting the outward form of the various kinds of whales which baffle the taxidermist's art on account of the oily nature of their skin. At last, however, Sir William Flower has solved the problem in a most satisfactory manner, and the result is a unique addition to the Department of Zoology in the museum over which he presides."

The solution referred to consists in exhibiting *papier maché* casts of one-half of the exterior of the various cetaceans, colored as in life, and placing the skeletons in the concavities of the casts.

Sir William Flower would, I am sure, disclaim originality for this excellent mode of exhibiting cetaceans, as it has been in use in the National Museum for more than fifteen years. In the Report of the Smithsonian Institution for 1882 (p. 125) will be found the following statement:

"Mr. Joseph Palmer, chief modeller, has been engaged during a large part of the year in mounting the skeleton and cast of a humpback whale, 33 feet in length, which now stands in the south main hall. This is the largest cast of an animal that has yet been made, and is unique in conception. Viewed from the left side, the visitor sees the cast of a whale in the attitude of swimming through the water. Standing on the right, he sees the concavity and inner outline of the half cast, in which against a suitable background is mounted the articulated skeleton of the animal."

This interesting specimen is now in the south hall of the Museum, where it has been exhibited since 1882. The idea of showing exterior and skeleton together originated, I believe, with Professor Baird, who took great interest in the specimen referred to, and never failed to point it out to his friends when passing through the Museum.

The Museum has a large series of painted casts of the smaller cetaceans, some of which were made as early as 1874, and a number of replicas were shown at the Berlin Fisheries Exhibition in 1880 and were afterwards taken to London at the time of the Fisheries Exhibition in 1883. Some of these, if I remember correctly, were left in the British Museum by Dr. Goode at the close of the latter exposition.

FREDERICK W. TRUE.

U. S. NATIONAL MUSEUM,
July 11, 1898.

SCIENTIFIC LITERATURE.

A Treatise on Magnetism and Electricity. By ANDREW GRAY, LL.D., F.R.S., Professor of Physics in the University College of North Wales. Macmillan & Co. 1898.

The first volume of this treatise awakens a strong desire in us to see the second volume which is promised. The author in his preface states that his effort has been to produce not a work on the mathematical theory of electricity merely, but also to describe the fundamental phenomena, and "to show how they fall into their places in the general scheme of electrical action, and to point out the consequences to which they lead."

There have been many attempts to simplify and amplify Maxwell's great work, and the student now has various aids to enable him to comprehend it, which were not accessible twenty years ago. A distinguished professor of physics once pointed out to me two editions of Maxwell's book, worn and dilapidated by constant use, and remarked: 'I am proud of them.' That treatise certainly contained strong food. Long grappling with it and night oil burned in studying it led to a certain grip of the subject, the evidence of which we see in such books as Professor Gray's. The student now has Poincairé's treatise; Helmholtz's lectures on the electrodynamic theory of light, Drude's Physik des Ethers; Oliver Heavyside's work; Professor J. J. Thomson's Electricity and Magnetism, Hertz's Modification of Maxwell's fundamental equations, Webster's Electricity and Magnetism, and the work before us.

A critic should carefully examine the aim of the author and should not take him to task for omissions that were made designedly, and should not endeavor to instruct him in regard to what he should have done, but rather should aim at weighing what has been accomplished. One should, therefore, carefully read Professor Gray's preface, and heed its words in regard to

the limits to which he has confined himself. One will find in this work a strong appreciation of the remarkable papers of Oliver Heavyside and valuable chapters on the Elements of Hydrodynamics. Teachers will highly appreciate the introduction of such chapters in a work on electricity, for one of the principal difficulties in reading Maxwell's book arises from his obscure use of hydrodynamical equations. Indeed, I am tempted to regard this portion of Professor Gray's book as the most valuable to the student, leading him to see the importance in the modern treatment of electrical theories, of hydrodynamics, and compelling him to grapple with Lamb's classical work on this subject.

The author has embodied without essential change Hertz's mathematical discussion of electric waves, and further discussion of this subject is promised in the second volume. We, therefore, cannot venture to criticise his treatment of this subject. It is evident that he intends his treatment of this growing subject to be a full one, for the first volume before us contains Lorentz's remarkable theoretical prediction of Zeeman's discovery of the doubling and tripling of spectral lines in the magnetic field. We know of no other text-book at present which has incorporated the work of Lorentz, or one which contains such a well digested account of the fundamental equations of the electrodynamical theory of light. We confess to a certain feeling of disappointment at the author's treatment of electrostatics and of the vexed subject of displacement currents; perhaps in the imperfect state of our knowledge no better or fuller treatment is possible. Possibly the second volume will contain an analysis of Professor J. J. Thomson's theory of polarization and tube of force, and of Helmholtz's theory of ions.

The author has selected fundamental experiments with care, and the practical electrician will find much apart from the mathematical treatment which will interest him, notably a full account of Lord Kelvin's mariner's compass. A young electrical engineer who studied Maxwell's treatise with me ten years ago told me that when he first entered into the employment of a great electrical firm he was afraid to leave his copy of Maxwell where it might be seen, for fear that he would be considered a man in the clouds, unfitted by the study of mathematical theories to cope with practical problems of electricity. He now, however, leaves his copy boldly on his desk and in the workshop. Such has been the advance in the study of electricity among the new schools of electricians. And probably a copy of Professor Gray's treatise will be seen in the workshop along side that of Maxwell.

John Trowbridge.

Review and Bibliography of the Metallic Carbides. By J. A. Mathews. Smithsonian Miscellaneous Collections, 1090. City of Washington, 1898. 8vo. Pp. 32.

The Chemical Section of the American Association for the Advancement of Science in 1882 appointed a Committee on Indexing Chemical Literature, and in 1884 the Chairman of that Committee reported an agreement entered into with the Smithsonian Institution whereby the latter consented to publish Indexes to Chemical Literature upon recommendation of the Committee. The booklet under review forms one of this series. Mr. Mathew's plan has much to approve; he gives a synopsis of the methods of preparation, physical and chemical properties of the known carbides, considering them in alphabetical order, and following each are the references to the literature bearing thereon.

Examination of this review shows that Henri Moissan has contributed more to our knowledge of the metallic carbides during the last five years, thanks to his electric furnace, than all chemists had done in previous years. The production of acetylene gas from calcium carbide seems to have been announced first by Wöhler in 1862. No commercial use was made of this fact, however, until about 1893, when the Willson Aluminum Company, in this country, while experimenting upon the reduction of the alkali earths by means of carbon, found that calcium carbide was formed; this was regarded as a waste product until its properties of readily decomposing with water and yielding acetylene gas established its commercial value. Mr. Mathews, writing in 1897, says: "The cost of production is still rather high and the chances of acetylene gas being generally introduced for lighting pur-

poses in the immediate future are not very bright."

In a postscript to the Review the author gives the literature down to March, 1898, which includes no less than eight books on the subject published in Europe.

It is unfortunate that Mr. Matthews uniformly omits initials of authors' names, for Berzelius, Wöhler and Moissan this is well enough, but we notice the names of Brown, Clarke and Jones, who certainly need initials. However, the Review is a welcome addition to chemical bibliography.

H. C. B.

Brown Men and Women, or the South Sea Islands in 1895 and 1896. By EDWARD REEVES. London, Swan, Sonnenschein & Co. 1898. With sixty illustrations and a map. Pp 294.

The author of this account was born in New Zealand, and from early days was acquainted with the peoples of the Pacific island-world. In 1895–6 he made two voyages to several of its archipelagoes, the Friendly Islands, the Samoan, Fijian, Society and Cook groups, jotting down his observations and clicking his camera as occasion offered. His attention was especially attracted by the social condition and prospects of the native population. This he claims to depict with more accuracy and a better knowledge than most previous writers.

The result may be briefly stated. He considers that they would be far better off if European civilization, and especially the Christian religion, were not forced upon them. His particular antipathy is the missionary. That wandering worthy he regards as the evil genius of Polynesia, and he repeatedly urges that subscriptions to 'foreign missions' should be stopped once for all. There is little of interest in the ethnographic observations, although the author must have had good opportunities.

D. G. BRINTON.

Memory and its Cultivation. By F. W. EDRIDGE-GREEN. New York, D. Appleton & Co. 1897. Pp. 307.

The author of this book says in his preface: "After discovering the facts which led me to write on the subject of memory, I found that I could learn a subject in about a fifth of the time that it previously took me." As he could have done it so easily, it is a pity that he did not learn something about psychology and physiology before attempting to write on these subjects. It is scarcely necessary for the scientific reader to go further than the frontispiece to understand the character of the book. This is a queer looking section of the brain, showing the 'center of sensory memory' and the 'center of motor memory' in the basal ganglia connected with the 'seat of the faculties of the mind' in the cortex. Further on we are told that there are thirty-seven of these faculties. Parental love is a faculty, but not conjugality, because 'conjugality is not likely to influence a man who hates his wife.' The book contains the stock anecdotes and mnemonic devices that may be picked up from desultory reading, and the author would doubtless pass for a man of wide information and agreeable parts in ordinary society. But it is a mystery why such a book should be published, as the last volume of the 'International Scientific Series'—a series which has maintained such a high standard and includes so many important scientific works.

J. MCKEEN CATTELL.

SOCIETIES AND ACADEMIES.

ACADEMY OF NATURAL SCIENCES, PHILADELPHIA, JULY 5, 1898.

MR. BENJAMIN SMITH LYMAN referred to the belief that chlorophyl required light for its production and exhibited an onion which in the course of seven months, without special nourishment, had grown long, green shoots in a dark closet. A potato in the same closet had sent out sprouts, but they contained no chlorophyl.

PROFESSOR HENRY A. PILSBRY communicated the results of his recent study of the molluscan group Aplacophora, dwelling specially on the characters distinguishing it from the gastropods. The former were first believed to be worms, but the discovery of a radula in the gullet and of a nervous system like that of the Chitons places them among the mollusks. They have a straight allimentary canal, while in the Chitons it is twisted and coiled. Although

living in mud, the Aplacophora are not mud feeders. The loss of the foot and shell is probably accounted for by their habitat. All the known species are European, not a single form having been recorded from the coasts of the United States, although it is quite likely they exist there.

Papers under the following titles were presented for publication: 'Contributions to Tropical Herpetology,' by Robert Baird McLain; 'Critical Notes on a Collection of Reptiles from the Western Coast of the United States,' by Robert Baird McLain; 'The Eastern Reptiles in the Collection of the Museum of the Stanford University Zoological Department,' by Robert Baird McLain.

Edward J. Nolan,
Recording Secretary.

TORREY BOTANICAL CLUB, MAY 25, 1898.

The evening was devoted to discussion and exhibition of acaulescent purple violets, introduced by a paper on 'The Acaulescent Violets,' by Mr. C. L. Pollard, of Washington, D. C., read by Dr. Hollick. This paper, soon to be printed, was the result of field study of the last two years, mainly in the Middle States, from which States most of our original species-types were derived. Mr. Pollard now describes 18 species and 3 varieties. He remarked that for violet characters we must depend upon unremitting field work. Herbarium material is useless, except as fortified by previous familiarity with the appearance while growing. Large numbers of individuals must be studied and every feature of the environment must be noted. Careful attention must be given not only to habit, but to habitat, to texture of herbage, to color of the flowers, to position of the cleistogenes, to nervation, to shape and pubescence of leaves, and to the nature of the surrounding vegetation.

A series of mounted specimens illustrating this paper was exhibited by Dr. Britton, and a large number of fresh specimens were passed, the result of collections sent in by Miss Sanial and by Messrs. Rusby and Crawford, and by Drs. Rusby and Hulst.

Discussion of the Eastern, stemless violets followed, in which Dr. and Mrs. Britton, Dr. Rusby, Mr. Bicknell and the Secretary participated.

Dr. Rusby referred to a very small and apparently unique violet collected by him at Franklin, N. J., some years since, distributed by him as *Viola cucullata cordifolia* of Gray, and remarkable because only about one inch high.

Mr. Howe, in behalf of Professor Lloyd, its discoverer, exhibited the original specimen of *V. MacCloskiei* Lloyd, from the State of Washington.

Mr. Bicknell spoke of the confluence of many surely distinct violet species.

Dr. Britton said that, while a number of violet species are clearly isolated in character, there is every gradation from these to the more critical species. The latter show all kinds of intermingling. The tendency to atavism, especially in the earlier, not maturely formed leaves, is very strong and often suggests the paternity of a species.

Dr. Britton announced that about 25 violet species are now growing at the botanic garden.

After much discussion of the characters on which Mr. Pollard's species rest, the Club was adjourned to the second Tuesday in October.

Edward S. Burgess,
Secretary.

NEW BOOKS.

Vorlesungen über Theoretische Physik. H. von Helmholtz. Band I., Abtheilung 2 Vorlesungen über die Dynamik discreter Massenpunkte. Edited by Otto Krigar Menzel. Band III., Vorlesungen über die Mathematischen Principien der Akustik. Edited by Arthur König and Carl Runge. Leipzig, J. A. Barth. 1898. Pp. x + 380 and x + 256.

Practical Plant Physiology. W. Detmer. Translated by S. A. Moor from the second German edition. London, Swan Sonnenschein & Co., Ltd.; New York, The Macmillan Co. 1898. Pp. xix + 555. $2.

Proceedings of the American Association for the Advancement of Science. Forty-sixth Meeting, held at Detroit, Mich., 1897. Salem, The Permanent Secretary. 1898. Pp. xxx + 499.